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**SIGNIFICANT HEARING THRESHOLD SHIFT
IN USAF MILITARY PERSONNEL:
JANUARY-JUNE 1975**

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USAF SCHOOL OF AEROSPACE MEDICINE
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NOTICES

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This technical report has been reviewed and is approved for publication.

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Hearing conservation audiology reports received at the USAF Hearing Conservation Data Registry from January through June 1975 were grouped according to the Air Force Specialty Code, job description, shown for the individual. The 48,271 records surveyed included 46 job codes with 50 or more reports and 47 with fewer than 50. There were 5,298 records with no identifiable job code. The percentage of significant threshold shift was calculated for each record, with the total group revealing 23.21%. The percent significant threshold shift for each job code with 50 or more was calculated so that each could be compared to the average for the entire group. | | |

SIGNIFICANT HEARING THRESHOLD SHIFT IN USAF MILITARY PERSONNEL: JANUARY-JUNE 1975

INTRODUCTION

The U.S. Air Force established a hearing Conservation Data Registry to study the undesirable effects of noise on personnel who routinely work in noisy environments.¹ This Registry has operated since 1956, but routine computer processing did not begin until February 1975 when keypunching was initiated with data received in January 1975. Annual examinations are reported on AF Form 1490 (Hearing Conservation Data). On this form both the reference (baseline) and current audiogram are entered; and from these the threshold shift at each pure tone frequency, each ear, can be computed. These values are then used to determine whether or not a significant threshold shift (STS) exists.

The criterion for significant threshold shift is specified in AFR 161-35, Hazardous Noise Exposure. The first step toward applying the criterion is to classify the reference audiogram as A, B, or C. One criterion for STS is used if the reference is class A, and another criterion if the reference is class B or C. Class A reference audiogram is no hearing level greater than 25 dB at 500, 1000, 2000, 3000, 4000, or 6000 Hz, either ear; class B hearing level exceeds 25 dB at one or more frequencies, either ear, but does not average 30 dB or more in the speech range (500-2000 Hz), either ear; class C hearing level is an average of 30 dB or more in the speech range (500-2000 Hz), either ear. The criteria for significant threshold shift are as follows: class A reference audiogram--any shift of 20 dB or more; class B or C--a shift of 10 dB or more at 2000 Hz, or 15 dB or more at 3000 Hz, and/or 20 dB or more at 4000 or 6000 Hz, either ear.

Generally, threshold shift is used to identify personnel who may be experiencing hearing loss (even without realizing their hearing is being impaired), so that appreciable damage, especially within the speech range (500-2000 Hz), can be prevented. Simply stated, early identification of significant threshold shift can prevent significant hearing loss.

TECHNIQUE

Hearing data contained on AF Forms 1490 obtained during annual monitorings of military personnel and received at the Registry during the period 1 January-30 June 1975 were studied. The purpose of the study was to determine the number of military personnel within identifiable specialty groups who demonstrated significant threshold shifts. Only Forms 1490 that contained complete audiograms for both reference and annual tests for military personnel were used. From these records, the authors were

¹AFR 161-35. Hazardous noise exposure. Washington, D.C., 27 July 1973 (replaced AFR 160-3, 29 Oct 56).

also able to determine the number of military personnel whose Air Force Specialty Codes (AFSC) were not specified on the forms. Only the first two digits of each AFSC were used to categorize the Air Force job descriptions.

Significant threshold shift was searched on each form by computer. The computer, rather than examiner judgment, was used because previous studies have shown that examiners often fail to correctly identify STS. The computer determined class of reference, calculated threshold shift at each frequency, and then applied the appropriate criterion from AFR 161-35.

RESULTS

There were 48,271 annual audiometric evaluations received (January-June 1975) with sufficient information to determine the presence or absence of significant threshold shift. Of these, however, 5,298 records (10.98%) could not be assigned to a specific AFSC because a written rather than numeric job title had been used or there was no job identification entered on the form. These incomplete records, therefore, could not be included in the tables showing AFSC-related information. It is noted, however, that of the 48,271 total AF Forms 1490 received, 11,206 (23.21%) revealed a significant threshold shift. The 23.21% STS value can be used to identify subgroups as being better or poorer than average.

Table 1 lists 46 AFSCs as identified by their first two digits and provides an overview of the AFSC-identifiable records, showing the number within each specialty code that were received and how many of these had significant threshold shift. Pertinent percentages are also shown: The number of records received for each AFSC relative to the total received; the number with STS with each AFSC relative to the total records within that AFSC and to the total of all records with STS; and the total number with STS relative to the total records received. AFSCs receiving less than 50 records each are grouped together as "Other;" these are treated as an entity in Table 1 and listed separately in Table 2.

Table 3 lists the AFSCs with 50 or more records each in order of percentage with significant threshold shift. This table readily identifies a group's standing within the whole.

AFR 161-35 identifies 12 job codes as "primary noise exposure groups." Table 4 provides data from these 12 areas. Codes 59 and 71 are included in "Other" in Table 1 since fewer than 50 records were received for each of these codes. Records in the primary noise exposure groups account for 60.63% of the AFSC-identifiable records received (26,053 of 42,973) and 62.29% of those with significant threshold shift (6,093 of 9,782).

The two-digit codes in the tables have only brief descriptive titles and do not differentiate between officer and enlisted personnel. Some groups (such as 10, 11, 12, 13, 14, and 15) are made up entirely of officers, while others (such as 42 and 43) are entirely enlisted. Many jobs listed include both officer and enlisted personnel.

SUMMARY AND CONCLUSIONS

These results clearly show the importance of continual careful scrutiny of jobs other than those specified as primary noise exposure groups in AFR 161-35. Of the 48,271 AF Forms 1490 received during this 6-month period, 22,218 records were not identified as being from one of the primary noise exposure groups. While 5,298 of these had unknown job titles, 16,920 were specifically identified in jobs other than those listed in the regulation.

Nine identified job titles reveal more than 30% incidence of significant threshold shift: Nos. 14, 22, 25, 29, 40, 56, 75, and 80 from Table 1 (more than 50 records each), and No. 59 from Table 4 (17 records). Special attention should be given to all of these job categories to try to eliminate any unnecessary noise exposure. For some jobs the medical monitors will have problems pinpointing the source of the threshold shift. For example, persons in job code 14 are pilots who are older than pilots in codes 10, 11, 12, and 13. The older pilots are now in more management-related duties. Their threshold shift could be due either to previous noise exposure or to current excessive exposure secondary to more work on the flight line. Efforts to reduce the incidence of significant threshold shift need to be accelerated for these older people, and age alone should not be accepted as the causative factor.

AFSC 59 (marine) and 75 (education and training) jobs both show excessive threshold shift (64.71% and 50%). Although both job groups are small (17 and 82 reports respectively), each warrants special attention. The education and training group is probably made up of small arms instructors with frequent exposure to impulse (or impact) type noise, and the marine group is probably exposed to frequent engine noise. In any case, both groups should be afforded extra attention in the fitting of ear protection and indoctrination in its use.

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TABLE 1. AIR FORCE SPECIALTY CODES (JOB FIELDS) WHERE AF FORMS 1490 IDENTIFIED SIGNIFICANT THRESHOLD SHIFT IN HEARING

| AFSC | Job title | N | % of Total N | N w/STS | % w/STS | % of total N w/STS |
|------|---|-------|-----------------|------------|------------|--------------------------|
| | | | | | | |
| 09 | Misc incl instructors | 50 | 0.12 | 14 | 28.00 | .14 |
| 10 | Pilot-helicopter, transport | 2,249 | 5.23 | 367 | 16.32 | 3.75 |
| 11 | Pilot-fighter | 1,257 | 2.93 | 244 | 19.41 | 2.49 |
| 12 | Pilot-bomber | 586 | 1.36 | 87 | 14.85 | .89 |
| 13 | Pilot, misc & instructor | 1,176 | 2.74 | 208 | 17.69 | 2.13 |
| 14 | Pilot-operations | 1,056 | 2.46 | 346 | 32.77 | 3.54 |
| 15 | Navigator | 2,265 | 5.27 | 407 | 17.97 | 4.16 |
| 16 | Air traffic control | 90 | 0.21 | 24 | 26.67 | .25 |
| 17 | Weapons director | 126 | 0.29 | 23 | 18.25 | .24 |
| 18 | Missile operations | 354 | 0.82 | 66 | 18.64 | .67 |
| 20 | Space systems, intelligence | 99 | 0.23 | 28 | 28.28 | .29 |
| 22 | Navigator-observer, photomapping | 603 | 1.40 | 192 | 31.84 | 1.96 |
| 23 | Audiovisual | 73 | 0.17 | 17 | 23.29 | .17 |
| 25 | Weather | 95 | 0.13 | 18 | 32.73 | .18 |
| 27 | R&D management & aerospace control systems operation | 1,141 | 2.66 | 213 | 18.67 | 2.18 |
| 28 | Development engineering | 175 | 0.41 | 52 | 29.71 | .53 |

TABLE 1. (Continued)

| AFSC | Job title | N | % of Total N | N | % w/STS | % of total N w/STS |
|------|---|--------|-----------------|-------|------------|--------------------------|
| | | | w/STS | w/STS | w/STS | |
| 29 | System program management & communications operations | 167 | 0.39 | 64 | 38.32 | .65 |
| 30 | Communications-electronics | 534 | 1.24 | 118 | 22.10 | 1.21 |
| 31 | Missile maintenance | 518 | 1.21 | 89 | 17.18 | .91 |
| 32 | Armament systems maintenance & operator | 3,891 | 9.05 | 805 | 20.69 | 8.23 |
| 34 | Training-devices helper | 58 | 0.13 | 14 | 24.14 | .14 |
| 40 | Aircraft maintenance/avionics intricate equip maint | 297 | 0.69 | 91 | 30.64 | .93 |
| 42 | Aircraft accessory maint | 3,682 | 8.57 | 853 | 23.17 | 8.72 |
| 43 | Aircraft maintenance | 11,808 | 27.48 | 2,941 | 24.91 | 30.07 |
| 44 | Missile maintenance | 140 | 0.33 | 25 | 17.86 | .26 |
| 46 | Munitions | 2,052 | 4.78 | 478 | 23.29 | 4.89 |
| 47 | Motor vehicle maintenance | 260 | 0.61 | 77 | 29.62 | .79 |
| 51 | Computer technology | 155 | 0.36 | 44 | 28.39 | .45 |
| 53 | Metal-working helper | 1,257 | 2.93 | 306 | 24.34 | 3.13 |
| 54 | Civil engineering mech/elec | 932 | 2.17 | 219 | 23.50 | 2.24 |
| 55 | Civil engineering structural/pavement | 619 | 1.44 | 149 | 24.07 | 1.52 |
| 56 | Civil engineering sanitation | 53 | 0.12 | 16 | 30.19 | .16 |
| 57 | Cartography, tire protection | 341 | 0.79 | 75 | 21.99 | .77 |
| 58 | Fabric, leather, & rubber | 127 | 0.30 | 24 | 18.90 | .25 |

TABLE 1. (Continued)

| AFSC | Job title | N | % of Total N | N w/STS | % w/STS | % of total N w/STS |
|------|---|--------|-----------------|------------|------------|--------------------------|
| 60 | Transportation | 1,328 | 3.09 | 288 | 21.69 | 2.94 |
| 63 | Fuels management, fuel services | 743 | 1.73 | 152 | 20.46 | 1.55 |
| 64 | Supply management, supply | 172 | 0.40 | 41 | 23.84 | .42 |
| 70 | Administration | 126 | 0.29 | 36 | 28.57 | .37 |
| 73 | Personnel | 58 | 0.13 | 12 | 20.69 | .12 |
| 75 | Education and training | 82 | 0.19 | 41 | 50.00 | .42 |
| 80 | Intelligence | 85 | 0.20 | 26 | 30.59 | .27 |
| 81 | Security police | 1,149 | 2.67 | 222 | 19.32 | 2.27 |
| 90 | Medical | 137 | 0.32 | 34 | 24.82 | .35 |
| 91 | Biomedical sciences, medical | 64 | 0.15 | 18 | 28.13 | .18 |
| 92 | Biomedical sciences, aircrew protection | 128 | 0.30 | 32 | 25.00 | .33 |
| 97 | Nurse | 55 | 0.13 | 8 | 14.55 | .08 |
| | Other ^a | 600 | 1.40 | 178 | 29.67 | 1.82 |
| | Total ^b | 42,973 | | 9,782 | | 22.76 |

^a47 identifiable job codes, but with less than 50 records each received Jan-June 1975 (Table 2).

^bAn additional 5,298 reports were received, but with no AFSC identified; of these, 1,424 (27%) had significant threshold shift.

TABLE 2. AIR FORCE SPECIALTY CODES EACH IDENTIFIED ON FEWER THAN 50 AUDIOGRAMS

| AFSC | N | N w/STS | AFSC | N | N w/STS | AFSC | N | N w/STS |
|------|----|------------|------|----|------------|--------------------|-----|-----------------|
| 01 | 27 | 5 | 39 | 21 | 11 | 76 | 3 | 1 |
| 02 | 11 | 5 | 41 | 27 | 5 | 77 | 3 | 1 |
| 03 | 5 | 1 | 45 | 21 | 5 | 78 | 2 | 1 |
| 04 | 2 | 1 | 48 | 3 | 1 | 79 | 10 | 4 |
| 05 | 3 | 2 | 50 | 1 | 0 | 82 | 7 | 4 |
| 06 | 2 | 1 | 52 | 11 | 1 | 83 | 6 | 1 |
| 08 | 3 | 0 | 59 | 17 | 11 | 84 | 4 | 1 |
| 19 | 3 | 1 | 61 | 13 | 4 | 85 | 2 | 1 |
| 21 | 12 | 4 | 62 | 22 | 7 | 87 | 8 | 0 |
| 24 | 14 | 4 | 65 | 34 | 10 | 93 | 32 | 7 |
| 26 | 31 | 8 | 66 | 26 | 11 | 94 | 2 | 1 |
| 33 | 4 | 1 | 67 | 29 | 9 | 95 | 1 | 0 |
| 35 | 9 | 2 | 69 | 13 | 5 | 96 | 5 | 1 |
| 36 | 37 | 12 | 71 | 41 | 6 | 98 | 13 | 4 |
| 37 | 4 | 1 | 72 | 10 | 2 | 99 | 25 | 6 |
| 38 | 1 | 0 | 74 | 20 | 9 | Total ^a | 600 | 178 (29.67%) |

^a"Other" on Table 1.

TABLE 3. AIR FORCE SPECIALTY CODES^a LISTED BY PERCENTAGE
OF AUDIOGRAMS SHOWING SIGNIFICANT THRESHOLD SHIFT

| <u>AFSC</u> | <u>%</u> <u>w/STS</u> | <u>AFSC</u> | <u>%</u> <u>w/STS</u> | <u>AFSC</u> | <u>%</u> <u>w/STS</u> |
|-------------|--------------------------|-------------|--------------------------|-------------|--------------------------|
| 75 | 50.00 | 92 | 25.00 | 73 | 20.69 |
| 29 | 38.32 | 43 | 24.91 | 63 | 20.46 |
| 14 | 32.77 | 90 | 24.82 | 11 | 19.41 |
| 25 | 32.73 | 53 | 24.34 | 81 | 19.32 |
| 22 | 31.84 | 34 | 24.14 | 58 | 18.90 |
| 40 | 30.64 | 55 | 24.07 | 27 | 18.67 |
| 80 | 30.59 | 64 | 23.84 | 18 | 18.64 |
| 56 | 30.19 | 54 | 23.50 | 17 | 18.25 |
| 28 | 29.71 | 73 | 23.29 | 15 | 17.97 |
| 47 | 29.62 | 46 | 23.29 | 44 | 17.86 |
| 70 | 28.57 | 42 | 23.17 | 13 | 17.69 |
| 51 | 28.39 | 30 | 22.10 | 31 | 17.18 |
| 20 | 28.26 | 57 | 21.99 | 10 | 16.32 |
| 91 | 28.13 | 60 | 21.69 | 12 | 14.85 |
| 09 | 28.00 | 32 | 20.69 | 97 | 14.55 |
| 16 | 26.67 | | | | |

^aEach with 50 or more reports received Jan-June 1975.

TABLE 4. AIR FORCE SPECIALTY CODES IDENTIFIED IN AFR 161-35
AS PRIMARY NOISE CAREER FIELDS

| AFSC | Job title | N | % of all AFSC- identified reports (42,973) | N | % w/STS |
|------|--|--------|--|--------------------|------------|
| | | | w/STS | | |
| 32 | Armament systems maint and operator | 3,891 | 9.05 | 805 | 20.69 |
| 42 | Aircraft acces maint | 3,682 | 8.57 | 853 | 23.17 |
| 43 | Aircraft maint | 11,808 | 27.48 | 2,941 | 24.91 |
| 44 | Missile maint | 140 | .33 | 25 | 17.86 |
| 46 | Munitions and weapons maint | 2,052 | 4.78 | 478 | 23.29 |
| 53 | Metal working | 1,257 | 2.93 | 306 | 24.34 |
| 54 | Civil eng-mech-elec | 932 | 2.17 | 219 | 23.50 |
| 57 | Fire protection | 341 | 0.79 | 75 | 21.99 |
| 59 | Marine | 17 | 0.04 | 11 | 64.71 |
| 63 | Fuel services | 743 | 1.73 | 152 | 20.46 |
| 71 | Printing | 41 | 0.10 | 6 | 14.63 |
| 81 | Security police | 1,149 | 2.67 | 222 | 19.32 |
| | Total | 26,053 | 60.63 | 6,093 ^a | 23.39 |

^a62.29% of the 9,782 AFSC-identified records showing significant
threshold shift.